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Farm Science REPORTER

Vol. 4, No. 2

Iowa State College, Ames, Iowa

April, 1943



Just In Passing . . .

The Authors---

J. Brownlee Davidson, head of the Agricultural Engineering Department at Iowa State College discusses new haying methods, facts gathered by the Iowa Station, by the Extension Service of Iowa State College and by the Ohio Station. Joint author with him is

Don K. Struthers, extension specialist in agricultural engineering at Iowa State College. Don, as well as Dr. Davidson, has written for the *Reporter* before, and through his several years of extension work in Iowa undoubtedly is known to many of you.

G. M. Browning is project supervisor of research for the Soil Conservation Service. He is stationed at Ames and works in cooperation with the Iowa Agricultural Experiment Station. Dr. Browning in his boyhood lived on a farm in Missouri and studied soils at the Universities of Missouri and West Virginia.

P. Mabel Nelson is head of the Foods and Nutrition Department at Iowa State College. Dr. Nelson also has been chairman of the State Nutrition Committee since it was founded.

Frances M. Hettler, who is joint author in this issue with Dr. Nelson on home canning, is foods and nutrition specialist with the Extension Service of Iowa State College. Miss Hettler is from a Fayette County farm and has written before for the *Farm Science Reporter*.

Dwight Espe, member of the Dairy Husbandry staff at Iowa State College for some 17 years, has been a frequent contributor to the *Farm Science Reporter*.

Norman L. Jacobson is one of the many men formerly in research work at the Iowa Station who are now in the armed services. Mr. Jacobson is an ensign in the navy. He is a former Wisconsin farm boy, graduated at the University of Wisconsin and came to Ames to take graduate work.

Clawson Y. Cannon is head of the Dairy Husbandry staff at Iowa State College. Dr. Cannon needs no introduction to most of you since he writes frequently for the *Reporter*.

Carl J. Drake for many years has been watching the work, spread and control of the European corn borer because of the probability that we in Iowa would eventually have that pest to fight. Dr. Drake is state entomologist and head of Entomology and Zoology at Iowa State College.

H. M. Harris did much of the scouting work last fall in eastern Iowa to find out how widely spread the corn borer was. Dr. Harris is a member of Dr. Drake's staff at Iowa State College.

A. G. Norman tells how inoculation may affect the yield, the protein and oil content of soybeans. Dr. Norman is a member of the Agronomy staff (soils) at Iowa State College.

Reporter Reprints You May Want

One of the intentions when the FARM SCIENCE REPORTER was established 3 years ago was that articles in it might sometimes take the place of popular bulletins with a saving financially and, we hoped, might sometimes present the material better for farm people.

With that in mind, from the beginning we have stocked

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reprints of articles that seemed to have possible value for future years. Many of the early reprints and some of the later ones have gone out of print, but we still have many of them. A card or letter addressed to the Bulletin Office, Iowa State College, Ames, will bring you any of the following:

FS-18 Mechanical Pickers to the Rescue (a story of mechanical corn pickers); FS-21 If Hay Mows are Empty (a story of substitution of silage for hay as roughage for dairy cows); FS-24 Are Bugs in Your Corn?; FS-25 Lard Becomes a Preferred Cooking Fat; FS-26 Crossbreeding Hogs?; FS-27 Civets Are Rat Killers; FS-28 Alfalfa That Lives; FS-29 Handling Hot Soils; FS-30 Rubber Tires Lead; FS-31 Frozen Vegetables.

FS-33 Sorghum; FS-35 The Fowl Leukosis Battle; FS-38 Use Your Refrigerator Economically; FS-39 The Case of Phosphate Fertilizer; FS-40 Building New Corn Hybrids; FS-41 Lights Without Switches; FS-42 America Must Learn What to Eat; FS-43 Can You Trust Phosphorus Soil Tests?; FS-44 Keep Food Lockers Working; FS-45 Bromegrass; FS-46 Cows Are Good Bean Market.

FS-47 Cutting Labor Corners; FS-48 Store Eggs for Lean Months; FS-49 Keep Asparagus Coming; FS-50 Two-Fuel Ranges Mean Economical Baking; FS-51 Soybeans—New Vegetable for Iowa Gardens; FS-52 Harvest Labor Problems; FS-53 Wartime Rations for Young Calves; FS-54 Going to Have a Fire?; FS-55 Spraying Tough Weeds; FS-56 Enriched Bread Is No Fad; FS-57 Light up the Hen House; FS-59 Waxy Corn—a New Crop; FS-61 What About Soybeans in 1943?; FS-62 More Oats, Fewer Acres; FS-63 Do Beans Hurt the Soil?; FS-64 Feed Dairy Cows Liberally; FS-65 Inoculate Your Soybeans; FS-66 Conserve the Nutrients.

FARM SCIENCE REPORTER

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HAYING WITH LESS HELP

HAYMAKING in Iowa usually comes piling in on top of several other jobs. In this time of war with a shortage of workers, farmers will be casting about for the best way to get their haying done with less help.

In haying there is a mighty good chance to save labor. We have made some studies of haymaking methods at the Iowa Station, conducted a personal survey among farmers out over the state in 1942 and have reviewed a study of the Ohio Station

By J. BROWNLEE DAVIDSON
and DON K. STRUTHERS

which it made of newer methods of haymaking on Ohio farms.

These various studies show that one method may take two or three times as much labor for each ton of

hay made as another. The average acreage of hay on Iowa farms is 17.7 acres. This means that a lot of farms have very small acreages, so small that it is impractical to have a large investment in haymaking, labor saving equipment.

For many years the common method of making hay on Iowa farms has been to gather the hay from the windrow to a wagon rack with a hayloader and then to move the hay from the rack into the barn with a fork or slings. But recently

Above: A field forage harvester chopping hay out of the windrow. Below: Chopping hay with a stationary chopper and stacking it with slat fence aid. Fence is raised as the stack is built.





Some farmers who bale hay out of the windrow have made elevators for the loading of the bales onto the rack or truck. This saves both much time and hard labor.

sweep rakes have been replacing wagon racks when the haul would permit.

Our studies show that hay cures fastest in the swath, but the curing time isn't greatly prolonged if the hay is raked when a half to three-fourths cured; the leaf loss is small and the hay has a better color.

A few farmers prefer to omit the raking into windrows and gather the hay from the swath with a sweep rake. This saves some time at the expense of quality.

Those who have tractor mowers can save considerable time in mowing. A 7-foot tractor mower should mow an acre in 25 minutes, whereas a 6-foot mower drawn by a good team should mow an acre in about 48 minutes. If a field is smooth the side delivery rake can be pulled by a tractor to save considerable time. In 1941 at the Iowa Station it took a little less than half an hour of one man's time (0.42 man-hour) per acre to rake hay with a tractor-drawn rake.

New Handling Methods

Instead of all hay being handled on the farms now as loose hay, some farmers are chopping it and putting it in the barn or stacking it,

Above: The combined tractor sweep rake and stacker—a new haymaking machine.

Right: This is a windrow pick-up baler with an automatic twine-tying device. Bales are pushed onto a trailer as made.

and others are baling it out of the windrow. Each form of haymaking has its advantages and advocates. The method used depends much upon whether the hay is stored in the barn or put into stacks or temporary storage.

Let's assume that you are going to put your hay up loose, then what

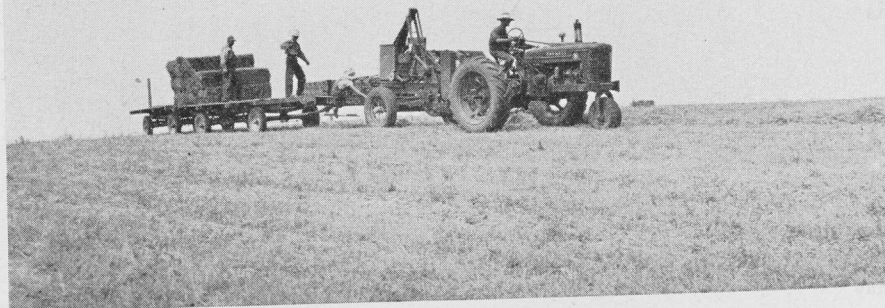
can you do to help reduce labor? We assume that if the haul is long you will use a rack and a hayloader in the field to pick the hay up from the windrow. First, build the load up in the rear of the rack so that you can push the hay that follows forward and downward. That will save labor.

If you are using slings, try putting them crosswise of the rack and use a short rack. In that way the slings can be placed before you start loading and you will not have to stop when half loaded to place the second pair of slings. Fill the rear end first and the front end last, then at the barn pull the load in the front slings into the mow first and the rear slings last.

If the haul of hay to the barn is short, one of the newer methods is to use a sweep rake (also called buck rake) instead of hayloader and rack. The load can be dropped at the barn on top of slings which have previously been placed, or it can be taken up with a fork. Tractors with a reasonably high road speed of $3\frac{1}{2}$ miles an hour or more make this practice satisfactory for hauls of a half mile.

A sweep rake built on an auto or truck chassis may travel up to 20 miles an hour, making longer hauls practical. In the studies we made and reviewed, the big saving in labor per ton of hay was in using the auto sweep rake. The other sweep rakes, however, did save on the average nearly a third of a man-hour per ton (see the table).

In stacking loose hay in the field, about a third of the time was used per ton with sweep rakes as com-



pared with using a hayloader and wagon racks. Field baling used only about half as much time per ton of hay as hauling it with wagon racks and stacking in the field and less than half as much time as hauling it to the barn in wagon racks. But when the time for picking up the bales in the field and storing them in the barn is added, the labor saving was lost. Of course about four times as much hay can be stored in a given space when baled. There are machines for reducing the labor in picking up bales in the field.

Chopped Hay

Another of the newer methods of haymaking and a growing one is to chop the hay. Chopped hay is sometimes stored in the barn, but probably more often stacked. The older practice is to load the hay on wagons and chop it at the barn, blowing it into the mow. Our early studies show that this consumes about as much time as storing loose hay with hay fork equipment. But with a sweep rake instead of a wagon rack and a stationary chopper and blower at the barn, some time is saved. Likewise, the field forage harvesters which have come into use in very recent years require fewer man-hours per ton of hay put up.

One way chopped hay saves labor is that it is so much easier to remove and feed. It also saves mow space because much more can be stored in a given space. In putting chopped hay into the barn, care must be used to see that it is sufficiently dry to avoid danger of fire. To be safe it must be drier than hay put up loose.

The forage harvester is one of the most recent developments in hay-making machinery. This will either pick up and chop dry hay from the windrow or cut and chop a standing crop in the field. In most instances the hay chopper is driven by tractor power take-off although with the larger machines an auxiliary engine is used.

Top: Sweep rakes mounted on chassis of autos or trucks are replacing hayracks.

Center: Here the hay is unloaded to be drawn by a fork into the barn haymow.

Right: Slings may be used for lifting hay hauled to barn by auto sweep rake.



**AMOUNT OF LABOR USED IN HANDLING DRY HAY BY DIFFERENT METHODS
INTO STORAGE FROM WINDROW IN FIELD**



This farmer places his slings crosswise of a short rack and so does not have to stop when he's half loaded in the field to arrange the second pair of slings.

One of the important problems in handling chopped hay is getting the hay from the wagon or truck box into storage. A blower is customarily used, but the labor required to feed the chopped hay into the blower may be excessive. Numerous techniques and pieces of equipment are being developed. These consist of dumping boxes, boxes with sliding bottoms or drag chains. A very simple and satisfactory arrangement is to use a box that is short but deep. This materially reduces the labor. Providing the blower with a long conveyer and equipping boxes with hinged or removable sides also help with the unloading.

Chopped hay can be stored in the field in temporary storage. Successful stacks have been built by using a ring of slat fencing to hold the chopped hay until it is sufficiently settled to stand in a vertical pile. As the stack is built the fencing is raised.

Another growing practice on Iowa farms is to chop the green hay crop and make silage of it. A blower is commonly used to elevate the chopped grass into the silo, but the labor of feeding the material into the blower is greater than for dry hay because of its weight.

In the rainy seasons more valuable feed may be obtained from a hay crop by making it into silage

Form of hay Kind of storage	Equipment used	Labor		
		Number men in crew	Tons handled per hour	Man hours per ton
Loose dry hay Stored in barn	Hay loader, wagon racks, hay fork and carrier	8 8 3.4 (av.)*	3.88 2.68 1.1*	2.06 3.0 3.1*
	Tractor sweep rake, slings and carrier	4 2.6 (av.)*	2.72 1.3*	1.47 2.00*
	Auto sweep rake, hay fork and carrier	4 3.1 (av.)	3.31 1.8	1.21 1.7
Loose dry hay Stored in field stack	Hay loader, wagon racks, pole stacker, hay fork	5	2.7	1.85
	Hay loader, wagon racks, cable stacker	3	1.2	2.50
	Tractor sweep rake, pole stacker, hay forks	1	1	1.0
	Tractor sweep rake and stacker	2.2 (av.)	2.8	.8
Field baling	Pickup baler	3.5 (av.)	3.2	1.1
	Pickup baler, automatic twine	3	3.3	.91
	Pickup baler, rotary	1	4.28	.23
Collecting bales Stored in barn	Tractor-drawn sled, slings	3	1.49	2.02
	Trailer after baler, hauling with teams	2	2.88	.7
Baling and collecting Storage in barn	Pickup baler, various equipment	3.2 (av.)*	1.2*	2.7*
Chopped hay Stored in barn	Sweep rake, stationary chopper	4 2.3 (av.)*	2.40 1.7*	1.66 1.52*
	Field forage harvester, stationary blower	4 3.6 (av.)*	2.56 2.9*	1.56 1.2*
Chopped hay Stored in stack	Sweep rake, stationary chopper	4	4.2	.95
Grass silage Stored in silo	Hay loader, wagon racks, stationary chopper	8	5.72	1.4
	Forage harvester, trailers, blower	5	6.58	.76

Source of Data:

College Farms.

Iowa Survey Among Farmers.

*Ohio Survey, Mim. Bul. No. 146, A Study of the Newer Hay Harvesting Methods on Ohio Farms, F. I. Morison.

than attempting to make dry hay. In order for this kind of silage to keep satisfactorily, ground corn or sorghum needs to be added with the chopped grass.

A study of the table and pictures accompanying this article may suggest to you ways and means of cutting your haying labor. We know that buying new equipment is almost impossible this year, but some of the equipment shown here was made by farmers, and many of the ideas presented came from farmers.

After the war is over, one may look for great advancements in haymaking

machinery. Our methods of making hay have been about the same for a good many years. Implement manufacturers now are much interested in getting into this field of providing new and improved equipment.

Perhaps some of the changes we have indicated will become more common and others not yet developed may come into use.



Tipping the wagon or truck toward the blower helps unload the chopped green crops.

ON THE CONTOUR

More Corn More Beans

By G. M. BROWNING

ONE WAY that Iowa farmers who have sloping land can produce more per acre and per man is to plant their crops on the contour. We have thought this is true, but during the past year the Iowa Station and the Soil Conservation Service in cooperation with Iowa farmers conducted some experiments to try to get some measure of *how much increase* one could expect by planting corn and soybeans on the contour as compared with planting up and down hill.

If the results of 1942 are what one may generally expect, then the increase in yield will be around 6 bushels an acre for corn grown on the contour and about 3 bushels for soybeans. Of course one should not put too much reliance on the results of 1 year. We shall need many more tests over a period of several years in different parts of the state to say positively that one may safely expect an increase of a certain amount per acre.

Our tests in 1942 were made on seven soil types in fields of 14 counties. The soil types used were: Fayette, Carrington, Tama, Haig, Shelby, Marshall and Knox.

Areas for the tests were selected within each field which had been cropped the same in the past and which were uniform in soil, slope and erosion. A part of each of these uniform test areas was planted and cultivated on the contour.

When we harvested these fields for yield, we compared areas side by side



It takes less power to farm on the contour than it does the up-and-down hill way.

in each field that had been contoured and farmed up and down hill. In the 30 fields of corn where we made these tests, 27 showed larger yields from the contoured areas and 3 decreased yields. When the results were tested for statistical significance, 16 showed significant increases. Eleven more which showed increases were not significant and the decreases in the three fields were not significant.

With the soybeans, the contoured areas in 21 fields showed significant increases and six more showed increases, but not large enough to be significant—they may have been the result of chance or error rather than the way they were farmed. The other three fields showed decreases, but they were not significant.

In exact figures, corn on the contour outyielded the up-and-down hill corn 6.2 bushels an acre; the contoured soybeans outyielded the up-and-down hill beans 3.2 bushels an acre.

Over a period of years, the average

increase in yield will vary some from these values, but for the moment let us assume the 1942 figures and calculate the increase in bushels of corn that Iowa farmers might have raised if all of the estimated 5 million acres of corn planted on sloping land in 1942 had been on the contour. Five million acres times 6.2 bushels per acre is 31 million bushels of corn—enough to fatten out 2 million hogs. Similar calculations can be made for increases in oil that might have been produced if all of the soybeans planted on sloping land had been on the contour.

The results we are reporting were obtained in a year when moisture was adequate or excessive. It generally has been thought that the beneficial effect of contouring was largely due to the extra moisture saved by contouring. How, then, can the 1942 results be explained when moisture was probably not a limiting factor?

Records of rainfall in 1942 show that there were more hard, driving

**Increase of Contour-Grown Corn 6.2 Bushels
an Acre and of Soybeans 3.2 Bushels in 1942**

rains than usual during the growing season. These caused excessive gulying between the rows. Many of the roots were exposed and, in some cases, plants were even washed out of the ground. These roots were destroyed by exposure or later cultivation. Apparently the feeding power of the plant for water and plant nutrients was reduced enough to decrease the yields. Increased yields from contouring can also be expected in drouthy years, when there are no heavy rains to cause damage by severe gulying.

Studies conducted on a Marshall silt loam soil at the Clarinda Experimental Farm from 1933-39 show that the loss of soil and water from rows listed up and down hill is about five times that from corn listed on the contour. Each furrow acts as a barrier which checks the velocity of the surface runoff, causing it to unload its silt and allow it more time to soak into the soil so that it will be available to the plant.

Listing, with its large capacity to hold water, is more effective in conserving soil and water than furrow

openers or surface planters, the furrows and ridges of which have a rather limited capacity to hold water. But even though the furrows formed by the implements are small, the additional moisture which they save on the contour may be very helpful in carrying the crop through the dry period. Moreover, the fertility loss in the eroded material will, over a period of years, be sufficient to greatly decrease the productivity of the soil.

Corn on the contour must be drilled, and even if contouring increases yields and saves soil and water, can drilled corn be kept clean? This is a question frequently asked by farmers who have not contoured in the past. The experience of those who have tried it is that weed control may be a little more difficult in unfavorable seasons, but it is not a serious problem.

In addition to increasing yields and saving soil and water, contouring has another advantage—it saves tractor fuel. Tests have shown that savings of 5-10 percent in fuel may be expected when the tractor is operated on the level

instead of up and down hill.

There is nothing complicated about contouring. It may require a little more time to begin

with, but when you have it started it is just as natural as the old method of checkrow planting. Anyone with an ordinary level or other suitable instrument can lay out a contouring line. Bulletins and leaflets are also available* which outline in a simple fashion the steps to be followed in contour farming.

Increase Most Years

In general, yield increases can be expected from contouring in years when rainfall is deficient or when there are a number of hard rains that cause severe gulying in the rows planted up and down hill. Since there are usually one or more intense rains each year that cause severe erosion, increases in yield from contouring can likely be expected in most years. The saving of soil that results from contouring is in itself sufficient to justify the practice without taking into consideration any immediate increase in yield or the saving in power that results from carrying out the farming operations on the contour. The loss of top soil is costly on any farm.

With all of the desirable features of contouring and with the additional food needed, farmers can help meet their goals by planting their corn and soybeans on the contour if the land is sloping and subject to erosion.

An increasing number of Iowa farmers with sloping land are planting crops on the contour and are finding it an excellent way to step up yields and prevent soil loss.

*You can obtain these from the county extension director, AAA committeeman, or representatives of the Soil Conservation Service.



Left: Soybeans planted up-and-down hill washed more than if planted on contour.

Below: Much of this type washing can be avoided when planting is on contour.



By P. MABEL NELSON and
FRANCES M. HETTLER



6. Pack vegetables only medium hard in jars to allow for enough liquid.

7. Store canned foods at low temperatures.

8. Process quart jars of vegetables longer than pints.

9. Keep water circulating completely around the jars.

10. Check for physical evidences of spoilage when opened by noting the odor of the first steam that comes from the boiled vegetable.

More than 2,000 pints of non-acid vegetables, tomatoes and meats were canned in the hot water bath in an effort to find out what effect different practices have on the keeping quality.

One of the most important factors in successful use of the hot water bath method is processing time. Satisfactory processing time for beans and chard in these tests was found to be 2 hours; beef and pork, 3 hours; tomatoes, 20 minutes. When acid was added before asparagus and corn were processed for 2 hours, the products kept better than when they were processed without acid for 3 and 4 hours, respectively.

The effect of delay in processing

Canning Food That Keeps

THE HOT water bath method of processing canned foods has been given a nod of approval by research workers.

Scientists, a bit skeptical that food processed in the hot water bath would keep successfully, set about to study the method. Results of the study serve as a guide to homemakers in 1943 as the food situation threatens to become even more serious than in 1918.

Three canning studies* conducted at Iowa State College show that the hot water bath method is satisfactory, provided these precautions are followed:

1. Process foods a sufficient length

of time.

2. Process vegetables as soon as possible after gathering from the garden.

3. Follow through the canning steps as rapidly as possible.

4. Boil vegetables and pack while hot into glass jars.

5. Use new caps for non-acid vegetables.

*Material presented in this article is based on the following studies in home canning: 1. Some Factors Affecting the Keeping Qualities of Vegetables and Meats Canned by the Hot Water Bath Method, by Gertrude Sunderlin with P. Mabel Nelson and Max Levine. 2. Indices of Spoilage in Home Canned Foods, by Gertrude Sunderlin with Max Levine and P. Mabel Nelson. 3. Heat Penetration in Meats and Vegetables Processed in Glass Containers, by Gail M. Redfield, P. Mabel Nelson and Gertrude Sunderlin.

after food is precooked is uncertain. But the study showed that the canning process should be carried through as rapidly as possible.

Vegetables allowed to stand a day or longer before canning showed considerable spoilage and required longer processing time. For example, where 20 minutes was long enough to process tomatoes canned shortly after they were gathered, no time less than 35 minutes was sufficient to prevent spoilage of tomatoes that had been stored 2 days.

The condition of caps and rubbers had a definite effect on canned food spoilage. No spoilage occurred in 24 pints of beans that had new alum-

inum and zinc caps. Twelve pints with rubbers used the preceding year did not spoil. But when caps from jars of beans that had spoiled the year before were used on 24 pints, and the beans were processed 2 and 2½ hours just as were those with new lids, more than one-sixth of those processed 2½ hours spoiled. One-fourth of those processed 2 hours spoiled. The spoilage occurred despite the fact that the old lids were washed well and boiled 5 minutes before being used.

Storage temperatures also had a decided effect on the keeping qualities of canned beans. Those stored at temperatures under 75 degrees F. showed no spoilage. But temperatures ranging from 99 to 131 degrees F. resulted in spoilage of from 66 to 100 percent. This indicates that sterility was not obtained, but the process time was sufficient to yield canned food that would keep when stored at lower temperature.

The addition of acid to non-acid vegetables increased the probability of their keeping when processed a shorter length of time. For ordinary home canning, lemon juice is recommended in the following amounts and processing times:

	Tsp. lemon juice per pint	Processing time	
		Pints	Quarts
Asparagus	1½ tsp.	2 hrs.	2¼ hrs.
Snap beans	1	1½	1¾
Swiss chard	1	2	2½
Corn	2	2½	3½

One-fourth teaspoon of soda added to a pint of corn as it was heated for serving eliminated the objectionable acid flavor. The vitamin content of corn is so small that the food value lost is negligible. Acid flavor was not objectionable in other vegetables.

Pack Hot

The second phase of the study was a series of experiments designed to show how rapidly meats and vegetables in glass jars absorb heat.

Different amounts of water, bone and fat have only slight influence on heat penetration in jars of meat, no matter whether the boiling water bath or pressure cooker is used. Heat reaches the center of the jar of precooked meats more slowly than of raw. But cooked meat requires a shorter processing time because it is hot when the process starts.

To find out how rapidly beef fat

and beef muscle become heated through, two jars were packed solidly with beef round and two with beef suet. The jars were then processed in the hot water bath. Heat penetrated the jar of beef more rapidly than the jar of suet until the melting point of suet was reached. Then the temperature in the jar of suet rose almost as quickly as if it had been filled with water.

Vegetables packed loosely required less time for the temperature at the center of the jar to reach the temperature of the water bath or pressure cooker than those packed solidly. Green beans packed loosely in pint jars required 20 minutes to reach the processing temperature; those packed medium tight required twice as long, and those packed hard required three times as long.

Swiss chard packed loosely kept better than when the jars were solidly packed, and kept satisfactorily with a shorter processing time. More time is required for heat to get to the center of the jar when chard is packed tightly.

For heat to reach the center of a jar of corn requires a longer time than for many vegetables because of its pasty consistency. A loose pack and a high starting temperature in home canning of corn should give best results. Corn packed hot reached processing temperature 30 minutes sooner than that packed warm or cold.

In general, medium packs are more desirable than either loose or hard packs in both convenience of packing and appearance.

Because longer time is required for heat to reach the center of a quart jar than a pint, additional time should be allowed for quart jars when a processing time table specifies pints. Additional time lengths suggested are: For beans, asparagus and spinach, 10 to 20 minutes; for tomatoes, 10 minutes; for sweet corn, 60 minutes; for beef, 30 minutes, and for pork, 50 minutes.

Use of the pressure cooker in canning non-acid vegetables is not the sole answer to the spoilage problem. The cooker must be operated properly. For one thing, unless the air is let out of the cooker before the petcock is closed, a lower temperature exists in the cooker than is indicated by the pressure gauge. To assure complete absence of air, the petcock should be left open for at

least 7 minutes after steam appears.

Looking for Spoilage

A third phase of the canning research dealt with indications of spoilage. While chemical, bacteriological and physical tests were used, physical evidences indicated spoilage more frequently than either of the others. Since only physical tests for spoilage are practical at home, they will be considered here.

Physical evidence was a good sign of spoilage in asparagus, beans, chard, tomato and beef, but not as good in corn and pork. Of the three physical tests—odor, appearance and suction—odor seemed to be the most common sign of spoilage. In beef, however, spoilage was indicated by changed appearance in more jars than by the odor. Appearance also was a good sign of spoilage in beans and chard.

Taste was purposely omitted from the study, because it is an undesirable and unwise test for canned food until it is boiled 10 minutes.

Appearance is naturally the first home test with these conditions indicating spoilage: (1) Gas production as shown by bubble formation; (2) bulged caps or broken seals; (3) cloudiness of the liquor; (4) sediment; (5) color; (6) consistency and disintegration, and (7) formation of patches of growth.

The suction or vacuum, a second physical test, was made by quickly pulling the rubber from beneath the zinc cap with a pair of pliers. A sharp sound due to intruding air is taken to indicate a satisfactory vacuum. A spurting of the liquid from the jar indicates pressure from the inside, and an absence of sound also is taken to mean an unsatisfactory vacuum. When a satisfactory seal is obtained, the zinc caps will be drawn in by suction due to a partial vacuum. Any raising or bulging of the caps indicates pressure from within, or an unsatisfactory seal.

The third physical test was the odor noted when the cap was removed.

The Agricultural Extension Service of any state makes available to all the citizens in the state canning directions suited to local conditions. Following those directions closely will prevent spoilage in a year when maximum food production and preservation are necessary.

Why Do Cows Bloat?



WHY DO COWS bloat on alfalfa or clover pastures but not on bluegrass? Is there something in clover or alfalfa and not in bluegrass or other grass pastures that causes bloat?

We can't answer those questions as we should like, but the studies we have made at the Iowa Station have given us some rather definite opinions. Here they are:

1. Bloating apparently is entirely a physical problem. We think it is because the cattle sometimes eat too much of these legumes in too short a time. It is not because sweet clover, red clover and alfalfa contain a "poison" or something that is bad and isn't found in grass.

2. Salt, soda, lime and similar "bloat remedies" will not prevent bloat because they are too mild in their action. Remedies which are powerful enough to prevent gas formation interfere with normal digestion and should not be used.

3. Feeding grain, dry hay or silage before putting cattle on legume pastures will help prevent overeating and, in turn, bloat.

4. Turning cows on grass pasture for half an hour or more before turning them on the legume will help if the grass pasture is green and succulent so the cows will eat it.

Experiments Indicate It's a Matter of Eating Too Much Too Fast and Not What Cows Eat

By DWIGHT ESPE, NORMAN L. JACOBSON
and CLAWSON Y. CANNON

5. Legume pasture with dew or frost on it may be more likely to cause bloating because it permits the cow to eat and swallow the forage faster. The dampened legume also may cut down the amount of saliva secreted, and saliva helps lessen gas formation.

6. As much gas is formed by bluegrass per pound of grass eaten as per pound of alfalfa.

Regardless of what cows eat—hay, grain, bluegrass or legume pasture—they are continually forming gas. Gases are formed which, if absorbed in sufficient quantities, may kill the cow. But normally a cow from time to time belches and rids herself of the gas. Apparently it's only when the opening from the stomach gets blocked with food that the cow starts bloating. After that we're not sure whether it's the pressure of the gas in the stomach or the absorption of certain poisonous gases that may finally kill the animal. In either case, the important thing is to pre-

vent the cow from eating so much so fast that the stomach cannot "mow it away" in the usual manner.

If a cow eats rapidly in a luscious, legume pasture for a couple of hours, she might consume 100 or more pounds of feed, our studies show. If she then takes a good drink of water and lies down to chew her cud and rest, the conditions are ideal for bloating.

Our theory is that under conditions like this, she has loaded up so heavily and gas forms so rapidly that the opening of the esophagus into the rumen is closed and the gas can't get out—the cow can't belch. So we think it best to let the cow drink before she goes onto the legume pasture, and if she has loaded up quickly with legumes, don't let her finish filling up with water.

We have at the Iowa Station a cow with a rumen fistula—a hole healed up down into her rumen—so that we can peek in and even reach inside the stomach to find out some-

thing about how she handles her food.

We used this cow in our experiments on bloat. She was fed fresh, young, green alfalfa, bluegrass and other feeds. Portions of these materials were then removed from the rumen (paunch) and tests run to find out what gases were formed. The gases formed by the green alfalfa were not greatly different in kind or quantity from those formed by bluegrass.

Then we put this cow and others out on alfalfa and bluegrass pastures, trying to produce bloat and to observe how the cows ate. We found that the cows on the alfalfa pasture were able to eat about three times as much per minute as when they were on bluegrass pasture. To arrive at this, the cows were accurately weighed before and after pasturing and all excretions collected and taken into account.

The cows ate about 1 pound per minute of the young, green alfalfa but only about 1/3 pound of bluegrass even on a good pasture. The reason for this, at least in part, is that the cows could pinch off the alfalfa, whereas grass had to be cut off against the sharp edges of the lower teeth.

We put bluegrass and alfalfa through a meat grinder and found that a given weight of ground alfalfa formed a much more compact mass than a similar weight of bluegrass. This probably is part of the explanation why one causes bloat and the other doesn't.

The cows used in our tests were fed a full-feed of grain in the evening and then were fed nothing before they went onto the pasture in the morning. Under these conditions we were unable to get any of the cows to bloat at any time. They

apparently just wouldn't eat enough of the alfalfa to cause trouble.

So one of the ways to prevent bloat, we think, is to see that cattle are not turned on legume pasture when they are very hungry. It is the filling up quickly with a heavy load of compact legume that seems to cause the trouble. Bluegrass or other grass pastures are more bulky and the cows can't fill up so fast on them.

Recommendations have sometimes been made to feed cows on legume pasture a mixture of equal parts of lime, salt and soda to prevent bloat. When we tried this and removed some of the material, we found gas forming faster than when the mixture was not fed.

One of the California stations has recently reported work which they did on bloat, and their results largely confirm ours. They, too, are of the opinion that bloating is a physical problem—the cow does not belch up the gas formed.

The California workers say "... bloat is caused not by excessive gas formation but by interference with belching. In our opinion bloat most frequently results from absence of the stimuli (like scratchy feed) to initiate belching. Fibrous roughage is effective because prickly. This bloat seldom occurs on rations of hay and grain."

Why do cows on some farms go along for years without bloating and then a farmer may lose several animals suddenly? We don't have the answer, but it is probably tied up with this business of eating too much too fast.

Dry cows seldom bloat. It is usually the milking cows or growing animals with the large appetites that gorge themselves and have the trouble. But knowing all this, suppose the cow does bloat, what should you do for treatment? Keep the cow on her feet and moving if possible. To induce belching, put a bit in her mouth as you would a bit

for a horse, or insert a piece of smooth, heavy hose in her mouth and *carefully* work it down the esophagus into the paunch. Be sure you don't get it into her windpipe.

After the gas has escaped, drench the cow through the tube with some antiferment recommended by your veterinarian. Before drenching, elevate the front feet to remove pressure on the heart and lungs. An ice pack or cold water poured on the bloated side will tend to check fermentation.

The general idea in treating bloat is to prevent further formation of gas and to eliminate that already present. If the cow is badly bloated and other methods fail, a trocar (or knife if a trocar is not handy) should be inserted in the left side at the highest point of the bloat. Do not remove the cannula covering the trocar (or rubber tube if a knife has been used) until all danger of bloat is past.

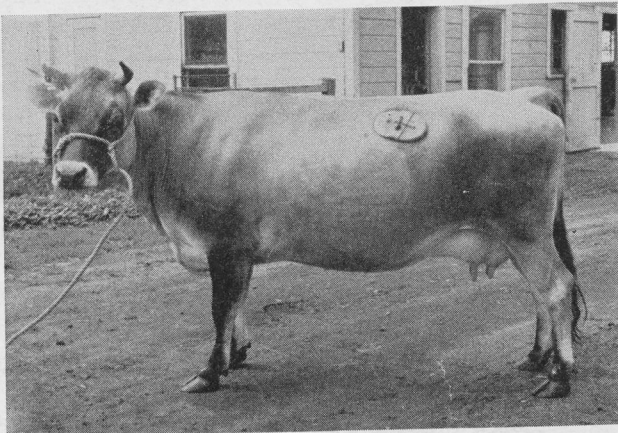
We can't afford to lose cows anytime and especially in wartime with the heavy demand for our meat supply and milk products. Feeding some bulky roughage before turning cattle on legume pasture and seeing that they are not too hungry or that they do not fill up with water when they are already nearly full of legume will help in prevention of bloat. But there just isn't any drug or a "something" you can give that will solve this bloat problem so far as we know.

Hybrid Chick Tests

The Iowa Station for several years has been inbreeding certain strains of Leghorn chickens, testing the effects of inbreeding.

Now these inbred strains are being crossed to develop so-called hybrid chicks that would correspond to our hybrid strains of corn which result from crossing inbred lines.

It has been found that the best results have come from crossing inbred lines of chickens that were not related. These have laid more eggs than have birds from inbred related lines that have been crossed, more than top-cross birds and more than the random-bred ones. They have also been superior in body weight, mortality and egg weight to all other types of inbred crosses, and better than the random-bred Leghorns in all these respects except egg weight.



This cow with a rumen fistula was used in the bloat studies so that we could remove samples of feed she had eaten to find out just how each acted.

NOW WE HAVE

Changes Now Are Not Suggested on Those Farms Having Borers

By C. J. DRAKE and
H. M. HARRIS

making any changes in their farming practices. When the borers begin to cause damage, recommendations will be made for control.

The nearest to Iowa that any commercial damage has been done is in the west side of Kankakee County, Illinois, which is about 150 miles east of Iowa.

Except for the infestation in sweet corn, the farmers in the five most heavily infested counties of Illinois last year were largely unaware of corn borer damage. The loss in yield of field corn in these five counties in 1942 is estimated at about 1 bushel an acre by Professor W. P. Flint of the Illinois Station. A loss of one bushel an acre is largely unnoticed.

Left: Borers work in all parts of the cornstalk. In this case one has worked through a kernel and into the cob.

Below: Borer tunnels in a stalk from a Clinton County, Iowa, field in 1942.



CORN BORERS

THE "famous" and "feared" European corn borer has arrived in Iowa. Last summer and fall we found borers in the corn fields of 19 counties in eastern Iowa—some of them in the third tier of counties west from the Mississippi River.

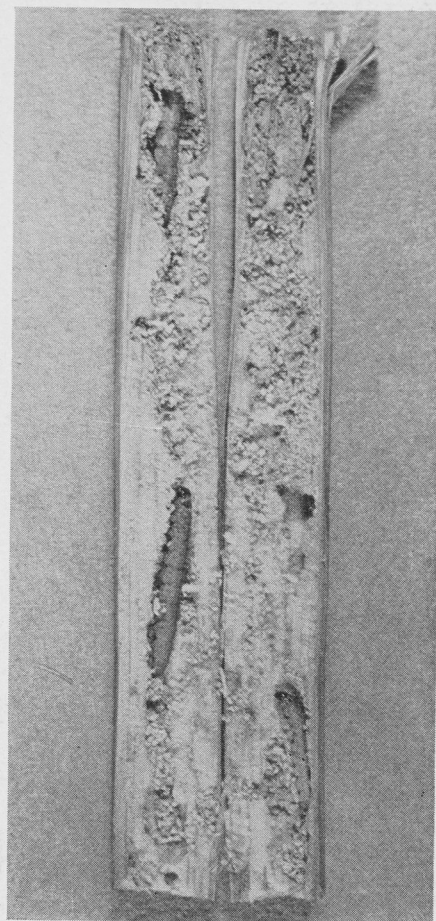
But despite the entry of the corn borer, there is no need of getting panicky, and Iowa farmers haven't. Usually the first sign of borer damage which farmers notice is broken stalks and tassels.

So far no commercial damage has occurred in Iowa and no one can predict at this time how soon we shall begin to have serious damage.

Our observation of the increase and spread of the borer in Ohio, Indiana and Illinois, where conditions seem most like those in Iowa, indicates that the weather will mostly answer this question of "how soon."

Last year conditions were excellent for corn and apparently just right for the borer. In fact, the last 3 or 4 years, which have been exceptionally good corn years, have also been exceptionally good for the borers. So the weather that favors corn most also seems to favor borers most.

For the present time we feel that there is no need of Iowa farmers



It may interest Iowa farmers to know that Flint estimates the Illinois borer population in 1942 increased from 200 or 300 percent to well over 1,000 percent—and 1,000 percent means 10 borers in 1942 where there was one the year before.

New Borer Strain

A new problem is now to be contended with. When the corn borer first began damaging corn in Michigan, Ohio, Canada and other areas, there was only one generation in a season, but now a multiple-generation strain has put in its appearance. Illinois entomologists reported 75 to 80 percent of the borers completed two generations in 1942.

Most of the experimental work with the control of European corn borer in the Lake Erie region has been done with the single-generation strain. Now we are confronted with this multiple-generation strain, and control measures must be worked out to cope with it.

Natural spread by flight may be expected until the insect has spread clear across Iowa. But enough research work and experience in control have been gained with the borer so that we can feel certain Iowa, Illinois, Missouri and other Corn Belt states will still be able to grow corn profitably despite the corn borer.

Experience in the infested states shows that it takes from a few to several years after the borer has become established in a new area for it to build up a large enough population to cause serious losses.

J. J. Davis of the Indiana Station reports that of the 62 counties surveyed during the past 2 years, the average number of borers per 100 plants was about 35 in 1941 and 193 in 1942. He gives the dollar losses in Indiana from corn borer as \$650,000 in 1940, \$1,236,255 in 1941 and the estimate for 1942 is placed at \$4,000,000. Some fields of early sweet corn in both Indiana and Ohio were completely ruined by borers.

The corn borer was first found in Ohio and Michigan in 1920, in Indiana in 1926, in Illinois in 1939 and in Iowa and Missouri in 1942. Although the corn borer was first found in Indiana in 1926, no commercial losses occurred until 1939—13 years later. The weather was abnormally dry and unfavorable to borer de-

velopment during a number of years in that period, which may account in part for the long period it took to build up a serious population of the pest.

Another factor besides the weather which aided the Indiana farmers but doesn't look so promising to us in Iowa is that there was only one brood of the borer during most of that period. Now with a borer strain producing two generations in a season, population may build up much faster.

Although farmers of Indiana, Ohio and other states with borers in their fields have had some losses, still they are growing corn successfully and are obtaining good yields. The amount of control which they have practiced has varied from season to season and from one region to another. In areas where little damage has been done commercially, control efforts have been slight.

Control Measures

In areas of heavy infestation it has been found that no single practice will control the borer, and corn growers there are urged to adopt as many of the control measures as possible and to cooperate with their neighbors in control, for much more can be accomplished in this way.

Here are a few of the important suggestions and recommendations for corn borer control in the Great Lakes states:

1. Destroy the overwintering borers in the field before the moths emerge by shredding or ensiling the corn, feeding corn fodder in barnyards and then raking up the stalks in the spring and burning them or plowing them under; completely plow under all stalks and stubble in the fall or early spring.

2. Avoid planting corn too early on fertile soil because the one-generation strain of moth prefers the tall and most vigorous corn for egg laying. Where the two-generation strain is dominant, late corn may also be heavily infested with the second brood. (We have something to learn about that.)

3. Plant resistant or tolerant strains of corn. No immune strains are known, but some hybrids seem to be a lot more tolerant or resistant than others. (The Iowa Station has been sending its hybrids into the borer-infested states for testing so

a good deal already is known about the resistance of our various ones.)

4. Changes in cropping practices and rotations in areas where severe damage has occurred are sometimes necessary. In Iowa it probably will mean, for example, that for oats in the spring, we shall no longer be able to disk the corn field and sow the oats. Instead, we may have to plow the stalks under.

5. Dusting or spraying to control the borer is too expensive except for early sweet corn for the early market.

These control measures are only possibilities for the future in Iowa. We are not ready for any of them yet. When the time comes, the Extension Service of Iowa State College will bring to you the best available knowledge on control. In the meantime, the Iowa Station will be finding out all that is possible about the best control measures for Iowa.

An example of the Iowa Station work is that for several years a part of the Iowa corn breeding program has included the testing of many hybrids for borer resistance. These tests, of course, have been conducted in the heavily infested territory co-operatively with other state and federal workers.

An orderly, coordinated and harmonized program of research, extension, regulatory and action programs is now being developed to deal with the corn borer in Iowa. This program will involve the Agricultural Experiment Station and Extension Service of Iowa State College, the Iowa Department of Agriculture as well as other state and federal agencies.

The Iowa program for 1943 will include such work as scouting to determine the rate of borer increase and spread, the proportion between one and multiple-generation strains, life cycle and seasonal history and the location of counties most favorable to borer increase; the breeding and testing of corn for borer resistance, the introduction of parasites and diseases which attack borers and the study of clean culture methods and various other farm practices of Illinois, Indiana and other states.

We are recommending no changes now in Iowa's corn growing practices, but we want to be ready with sound recommendations if and when the European corn borer does begin to cause serious losses in Iowa.

Inoculate for More and Better Soybeans

Helps Southwest Iowa Acre Yield of Beans, Oil and Protein; Contour Planting Is Helpful

FOR many years the experiment station folk, we of the Iowa Station included, have been telling you to inoculate your soybean seed. But just how much increase in yield can you expect from inoculation, and will it improve the quality of the crop produced?

The past year we carried on some experiments at the Soil Conservation Experimental Farm near Clarinda in Page County to try to get the answers to these questions.

Because these tests were being made in southwestern Iowa on sloping land and in a region which has not previously grown many soybeans but has begun to in order to help supply increased war demands, we wanted to know how much planting on the contour would help the crop. At the same time the methods of planting—such as shallow and deep listing, surface planting and drilling—were compared to find the one best suited to this region.

Briefly, this is what we found:

1. Inoculation stepped up the yield from about 15 bushels to around 19½ to the acre—31 percent.

2. Inoculation increased the protein content of the soybeans so that with the increased yield of beans, we obtained nearly a half more protein to the acre—47 percent.

3. Inoculation slightly decreased the percentage of oil in the beans, but because of the increased yield, we got about 25 percent more oil to the acre.

4. Inoculation left more nitrogen in the bean straw to be plowed under and enrich the soil after the beans were combined.

5. It took about \$14 worth of commercial nitrogen fertilizer to get as good yield from beans that were not inoculated as from those growing alongside, which had been inoculated

By A. G. NORMAN and
G. M. BROWNING

at a cost of less than 20 cents.

6. Beans planted on the contour were ahead in all of the different planting methods tried. A more extensive check of the results from contour planting is given in another article in this issue of the *Reporter*. We shall discuss here the results of our tests in Page County.

Inoculation Tests

Inoculation of soybeans is essential if nodulation is to be obtained when beans are planted on any field for the first time. The bacteria that produce nodules on soybeans will not do so on any other crop.

The inoculation experiment was planted on an almost level area of Marshall silt loam, typical of much of southwest Iowa. The area had been in corn the 2 previous years. The corn yields had been close to 60 bushels so that the fertility level might be considered reasonably good. The beans were planted in 21-inch rows and comparisons were made between 14 inoculated and uninoculated plots.

By mid-July the uninoculated beans could easily be picked out because of the lighter color of their leaves, which during August turned almost yellow and were shed at maturity well before those on the inoculated plants.

At \$1.50 per bushel the increase in yield of 31 percent which we obtained was worth \$6.90 per acre. Since the cost of inoculant would be less than 20 cents, there can be few more profitable expenditures.

Because the plants had an additional supply of nitrogen from the

Inoculating Soybeans

1. Increased Yield of Beans

31 %

Not Inoculated



14.7 Bu.

Inoculated



19.3 Bu.

2 Increased Protein Content of Beans

11 %

Not Inoculated



31.5 %

Inoculated



35.1 %

3. Increased Protein Produced Per Acre

47 %

Not Inoculated



278

Inoculated



407

4. Decreased Oil Content of Beans

5 %

Not Inoculated



21.4 %

Inoculated



20.2 %

5. Increased Oil Produced Per Acre

24 %

Not Inoculated



189 Lbs.

Inoculated



235 Lbs.

6. Increased Nitrogen in Bean Straw Residues Per Acre

29 %

Not Inoculated



17.8 Lbs.

Inoculated



23.0 Lbs.

air, the protein content of the beans was raised to such an extent that we obtained 47 percent more protein per acre from the inoculated beans. The oil content of the beans was slightly reduced by inoculation, but again on an acre basis, the amount produced was increased, this time by 25 percent. In the war effort, protein and oil are vital materials; no measure which can increase their production should be neglected.

Finally, a small effect, but one not without value, was produced in the amount of nitrogen in the residual bean straw which, after combining, would remain to be plowed under.

In the experiments with a nitrogen fertilizer, we did not expect that the use of nitrogen fertilizers with beans would be profitable, but we wanted to find out approximately how much fertilizer would have to be applied to get results equal to those produced by inoculated beans.

Three levels of nitrogen application were made, and it was found that without nodules, the plants had to be given nitrogen about equal to that in 540 pounds of sulfate of ammonia per acre, which would have cost about \$14.00. So, at little cost, results equal to those produced by \$14 worth of fertilizer were obtained.

Contouring Helped

The experiments on contouring and planting methods were made nearby on a slope that did not exceed 9 percent. Plantings were made by different methods on plots, some of which ran up and down the slope and some of which ran round the slope on the contour. The row-planted beans were spaced 30 inches apart. When listing was practiced, the yield on the contour was 2.8 bushels greater than on the up-and-down hill plots, similarly planted, an increase of 11 percent.

No difference was found between deep-listing and shallow-listing. Surface planting, however, was preferable to listing in 1942, and surface planted beans outyielded those listed on all plots by about 8 percent. Again there was an advantage for contouring, since surface-planted beans on the contour outyielded the up-and-down hill beans by 9 percent. All these beans were inoculated. In addition, however, we had some plots in which uninoculated beans were drilled solid. Contour-

Contouring Soybeans*

Increased Yield When Listed (Spacing 30")—Inoculated

11%



Up & Down Hill
25.7 Bu.



On Contour
28.5 Bu.

Increased Yield When Surface Planted

(Spacing 30")—Inoculated

9%



Up & Down Hill
27.9 Bu.



On Contour
30.6 Bu.

Increased Yield When Drilled Solid

(Uninoculated)

16%



Up & Down Hill
14.7 Bu.



On Contour
17.1 Bu.

*Experiments on Marshall Silt Loam

Page County—1942

Variety—Mukden

ing here also was preferable, since those beans drilled on the contour outyielded the up-and-down hill drilled beans by 16 percent.

Our results indicate that in whatever way the beans were planted, contouring was worthwhile, not only as a means of preventing losses of topsoil but also because the yield was increased from 2–3 bushels per acre. There are at least two reasons for this difference. First, there is conservation of water. The rain does not run off so easily as when the rows go up and down the slope, and consequently, more enters the soil to be available to the plant. Second, damage due to washing is much reduced. Heavy rains do not easily form little gullies on contoured beans, as they do on beans up and down the hill. In the latter we have observed small plants washed out or roots exposed

after sharp storms, so that it is not surprising that the yield suffers.

Apply Elsewhere?

Two questions that might well be asked are—How widely are these results applicable to other soils and other areas? Will the yield increase for inoculation always be 31 percent, and for contouring 2–3 bushels per acre?

As far as inoculation is concerned, the benefit to be expected depends largely on the general level of fertility of the land, particularly with respect to its available nitrogen. If the soybeans are well supplied with soil nitrogen, the effect of the additional amount provided by the bacteria will not be so noticeable, and consequently smaller yield differences may be expected as a result of inoculation. On soils low in nitrogen the percent yield increase may well be larger. Although our experiments followed 2 years of corn, we believe that the soil still contained a good supply of available nitrogen.

The results to be expected from contouring probably depend somewhat more on the season than on the soil type. In a parallel experiment on Shelby silt loam, also in southwest Iowa, the yield difference in favor of contouring was almost the same as on the Marshall soil.

In a season in which there are no heavy storms and in which the rainfall distribution is such that the crop is well supplied at all times, contouring would probably give no yield increase over up-and-down hill planting. But when the season is such that heavy rains may alternate with periods of dry weather, when soil moisture is low, contouring may be expected to give the best results. The latter is the more frequent and the more probable type of weather in southwest Iowa.

Iowa farmers who want maximum soybean yields will therefore be most likely to obtain them if they inoculate the seed and plant on the contour if their land is sloping.

Farmers will have the additional satisfaction of knowing that each acre production of these vital constituents, protein and oil, will be at a maximum.

This year experiments of a similar nature to those described above will be made in other areas of Iowa.